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HYDROUS GELS

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This invention relates to compositions of use in a number of fields and particularly to gels carrying or having incorporated therein an active ingredient whereby such gel may be used as a reservoir or depot for said active ingredient, and to methods of producing and of utilizing said gels.

It is frequently desirable or necessary to maintain a concentration of an active ingredient in a particular locality or environment in order to secure a specific action which is caused or enhanced by such active ingredient. An example is in the use of acetic acid solutions in wet dressing for the treatment of skin infections, as for example in the treatment of burns and of infected wounds. Such wet dressing technique has not been satisfactory due to its many limitations, and also because often it is impracticable for a given situation. It is known that surfaces denuded of epithelium vary greatly in the amount of fluid exuded. To maintain the optimal concentration of acetic acid at the surface of the wound requires adjustment of the concentration of the acid in accordance with the degree of dilution of the exudate.

Wet dressings require that the part of the body, being treated be unclothed and immobilized. Further the solution requires replenishment at frequent intervals. This is troublesome and impractical with an ambulant patient. In addition, gauze carrying the solution for a wet dressing is irritating to the raw area to which it is applied due to its abrasive or other physical action. Furthermore, the healing wound often grows through the interstices of the gauze and when removed necessarily traumatizes the area being treated with consequent regression in the healing process. The gauze also acts as a wick favoring the evaporation of solution supplied by capillarity and body fluids, which in turn, results in a concentration of electrolytes which may act as irritants because of the resulting change in osmotic balance. Nor is there certainty of control over the concentration of medicament, when, of necessity, the area must be kept open with consequent solution (water) evaporation.

A wet dressing also requires frequent attention and the required care is not always available. Because of the inherent porosity of a wet dressing and the necessity for keeping the area accessible, contamination and secondary infection by air-borne organisms often occurs. Also, it is difficult to keep a continuous liquid phase in contact with raw tissue. Or, considering the treatment of corneal ulcers, the use of solutions is disadvantageous in that it is impossible to immobilize the eye due to the necessity of frequently applying drops or solutions to maintain an effective concentration of medicament. In addition, the movement of the eye-lid over the ulcer is painful and healing is inhibited by mechanical irritation, thus slowing the process of epithelization. Further, in the treatment of body cavities or fistulae, whose location is such that they are drained by gravity, solutions can not be applied effectively.

Besides therapeutic utilizations, there are many other situations in which it is desired to maintain a source of

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supply of a given reagent or reactant, or of an acid or base to maintain given conditions of acidity or pH. Intermittent or continuous introduction of solutions offers a number of the same difficulties referred to above in the use of wet dressings.

Among the objects of the present invention is the production of hydrous gels containing an active ingredient which gel thus serves as a reservoir or depot supply for said active ingredient to a particular environment.

Further objects include such hydrous gels carrying a lower fatty acid such as acetic acid in effective concentrations for the utilization desired as for example in therapeutic amounts when used for therapeutic purposes.

Other objects include methods of producing such gels and their utilization.

Still further objects and advantages of the present invention will appear from the more detailed description set forth below, it being understood that such more detailed description is given by way of illustration and explanation only, and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

In accordance with the present invention, a hydrous gel is used as a carrier for an active ingredient so that such hydrous gel carrying said ingredient may be placed at the locality to which the active ingredients is to be supplied, and the gel will serve as a reservoir or depot supply for the active ingredient which is continuously supplied therefrom to the locality. Whether used therapeutically, or in chemical or physical processes, such hydrous gels carrying active ingredients may be used effectively to maintain a source of supply of active ingredient without requiring constant attention. The invention is particularly useful in therapeutic application and may well be illustrated by the use of hydrous gels carrying organic acids, such as acetic acid.

Various types of gels may be employed including both organic and inorganic gels. Thus hydrous gels may be made from inorganic components such as of silica, alumina, ferric oxide, etc., or from organic components such as carboxymethyl cellulose and other carboxy alkyl celluloses, pectins, polyvinyl alcohol, gelatin, partially oxidized cellulose, agar, fibrin, albumin, starch, etc. Such gels may be prepared by conventional methods and the active ingredient incorporated into them, either after production of the gel or preferably during its preparation. Thus water soluble active ingredients may be incorporated into the water or aqueous solution used in preparing the sol from which the gel is formed. Desirably the gels used in accordance with the present invention are hydrous gels or hydrophilic gels since for therapeutic purposes, water transfer is an important desideratum. Further, it is a simple matter to prepare such gels with thixotropic properties by conventional methods so that upon shaking they may be reduced in viscosity sufficiently for application as a fluid, but promptly set up to a substantially rigid structure or shape.

The character of active ingredient may vary depending on the particular field of utilization for the product. The invention will be illustrated by the use of aliphatic acids as the active ingredient. Many of the these acids exhibit a sufficient germicidal action for utilization for therapeutic purposes including lower monobasic (fatty) acids such as formic, acetic, propionic, butyric, and valeric acids, hydroxy monobasic acids such as glycolic and lactic acids, and polybasic acids such as malonic, succinic, oxalic, aconitic, and citric acids. All of these acids exhibit substantial bactericidal action but it should be kept in mind that various factors govern the activity exhibited, and some of the acids are more effective against one type of bacteria than against another. For example, acetic acid